

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)

		Date of mailing (day/month/year) see form PCT/ISA/210 (second sheet)	
Applicant's or agent's file reference see form PCT/ISA/220		FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/US2004/022864	International filing date (day/month/year) 15.07.2004	Priority date (day/month/year) 15.07.2003	
International Patent Classification (IPC) or both national classification and IPC C04B35/93, F01D5/28			
Applicant HONEYWELL INTERNATIONAL INC.			

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of Invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the International application
- Box No. VIII Certain observations on the International application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:

Authorized Officer

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/US2004/022864**Box No. I Basis of the opinion**

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - a sequence listing
 - table(s) related to the sequence listing
 - b. format of material:
 - in written format
 - in computer readable form
 - c. time of filing/furnishing:
 - contained in the international application as filed.
 - filed together with the international application in computer readable form.
 - furnished subsequently to this Authority for the purposes of search.
3. In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/US2004/022864**Box No. II Priority**

1. The following document has not been furnished:

- copy of the earlier application whose priority has been claimed (Rule 43bis.1 and 66.7(a)).
- translation of the earlier application whose priority has been claimed (Rule 43bis.1 and 66.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43bis.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. It has not been possible to consider the validity of the priority claim because a copy of the priority document was not available to the ISA at the time that the search was conducted (Rule 17.1). This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

4. Additional observations, if necessary:

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or
Industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Yes: Claims No: Claims	1-10
Inventive step (IS)	Yes: Claims No: Claims	1-10
Industrial applicability (IA)	Yes: Claims No: Claims	1-10

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the International application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**WRITTEN OPINION OF THE
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AUTHORITY (SEPARATE SHEET)**

International application No.

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Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following document:

D1: JP 2000 247748 A (KYOCERA CORP) 12 September 2000 (2000-09-12)

1. Novelty (Article 33(2) PCT)

a. The applicant uses the word "about" in many of the claims. Any value that is indicated with the word "about" is interpreted as being totally undefined, since it is impossible for the person skilled in the art to determine when a certain value is "about" the same as another value. Thus, none of the claims defines a composition range, nor are there any properties defined in the claims. The only thing that presently is defined in the claims in the presence of certain additional phases in the sintered silicon nitride product. Claims 5-8 presently do not contain any features in addition to the claims they refer to.

b. It does not necessarily need to be mentioned in the prior art that the silicon nitride ceramic contains beta silicon nitride, in order for this prior art document to be relevant for the question of novelty. It can be assumed that beta silicon nitride will be obtained if the silicon nitride ceramic is sintered or hot-pressed at high temperature.

c. As claim 1 is defined presently, the scandium oxide in the sintered silicon product does not need to be present in a separate scandium oxide phase. The way in which the scandium oxide is present in the sintered silicon product is not defined in claim 1, which means that the scandium oxide can be present in any phase of this sintered silicon product, including being present in a silicate phase.

d. It can be assumed that any sintered silicon nitride ceramic contains at least a trace amount of silicon carbide, since any ceramic powder mixture will contain, if no special measures are taken, at least a trace amount of organic contaminants, and these organic contaminants normally will convert at least partially to SiC during sintering of the silicon nitride ceramic. Since the amount of SiC is not defined in claim 2 (see also point 1a of this communication) and thus can also be a trace amount, any document that will be novelty destroying for present claim 1 will also be novelty destroying for claim 2.

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e. The applicant attempts to define the product of claims 9 and 10 in wordings of the process that was used to make the product, by defining the starting powders that have been used to make the product of claim 1. Regarding claims 9 and 10, the applicant is referred to the fact that claims containing a product defined in terms of a process of manufacture are admissible only if the products as such fulfill the requirements for patentability, i.e. *inter alia* that they are new and inventive. A product can not be rendered novel, just because it has been produced by a novel process (see The Guidelines for PCT Examination, part CIII, 4.7b).

It can for instance from the end product (a sintered silicon nitride ceramic) normally not be seen whether the silicon dioxide present in this sintered body is present because it has been added as a powder, or because the silicon nitride partially oxidised during sintering. Since any silicon nitride sintered body will normally contain some silicon dioxide, claim 10 does not add any feature to the claims it refers to.

f. Document D1 describes a sintered silicon nitride ceramic, made from a starting mixture of 84,5 mol% alpha-Si₃N₄, 5 mol% beta-Si₃N₄, 3 mol% Sc₂O₃, 7,5 mol% SiO₂ and 5 added wt% of SiC (sample 51, table 2). This mixture is densified in a two-step sintering process at 1750 °C and 1950 °C. Due to the high sintering temperature and the addition of beta silicon nitride seed it can be assumed that the alpha silicon nitride during sintering has converted to the beta form. In table 5 the properties of the sintered compact sample 51 are mentioned. It is 100% dense, has a fracture toughness of 9,6 MPa·m^{1/2} (measured according to JIS-R1607, see paragraph 38), four point bending strength of 700 MPa (410 MPa at 1500 °C) and an increase of weight of 0,09 mg/cm² after heating it in air at 1500 °C for 100 hours (see paragraph 38). Furthermore, in paragraph 47 it is mentioned that the grain boundaries contain disilicate, which causes a high oxidation resistance.

Thus, also taking into account points 1a to 1e of this communication, the subject-matter of document D1 is prejudicial to the novelty of claims 1-10, thereby not meeting the criteria of Article 33(2) PCT.

2. Inventivity (Article 33(3) PCT)

If the applicant deletes all the "abouts" in his application, and adds to the claims what is mentioned in points 3b and 3c of this communication (the essential presence of SiC and the fact that scandium oxide and scandium disilicate are grain boundary phases), claim 1 will be novel in comparison with the cited prior art.

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The question of inventive step will then arise. The difference between the amended claim 1 and the closest prior art (D1) will be the presence of the scandium oxide grain boundary phase. The applicant in his application states that his material differs from the prior art as having a higher fracture toughness and a better oxidation resistance at high temperature (of 1500 °C). It is evident that the oxidation resistance of the material of the application is not better than the oxidation resistance of the material of D1, in fact, it is even worse. It is more difficult to compare the fracture toughness of the material of the application with the fracture toughness of the material of D1, since the measurement methods are not the same. The fracture toughness of the material of D1 is substantially higher than the fracture toughness of the materials of the application, therefore it can be assumed that the fracture toughness of the materials of the applicant, when using the same measurement method, is not higher. The indentation fracture strength of the materials of D1 has not been mentioned in D1, but there is no reason to assume that the strength of the materials of D1 is lower than the strength of the materials of the application. In all, it seems that the materials of the application do not have more favourable properties than the material of sample 51 of D1.

It is therefore not clear what the technical effect of the presence of the scandium oxide grain boundary phase is, and which problem has been solved by the application.

Re Item VIII

Certain observations on the international application

3. Clarity and support (Article 6 PCT)

a. The relative term "about" used in all claims and in the description has no well-recognised meaning and leave/s the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claims unclear, Article 6 PCT.

b. It is clear from the description on page 10, table 1, that the following feature seems to be essential to the definition of the invention:

the presence of a certain amount of SiC in the sintered silicon nitride product

In all examples SiC has been added to the starting powder mixture. The applicant has not shown that it is possible to obtain the desired properties without adding SiC to his material. If the applicant, by submitting new examples (which can not be taken up into

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the application itself), can show that it is not necessary to add silicon carbide in order to obtain the desired properties, then it is not necessary to add to claim 1 that SiC should be present in the sintered material (at least not for clarity reasons). Otherwise, this feature should be taken up into claim 1.

c. Claim 1 (and all claims depending on claim 1) is not clear, since it is not clear in which way the scandium oxide is present in the sintered material. Specially claim 4 is unclear, since it mentions both the presence of scandium oxide and scandium disilicate. Claim 1 suggests that the scandium oxide can be present in any way possible, while in fact the applicant seems to intend that the scandium oxide is present as a separate phase. In order to clarify the claims, the applicant could take up into the claims the wordings of page 2, lines 15-16, mentioning that the scandium oxide and scandium disilicate are present as grain boundary secondary phases.